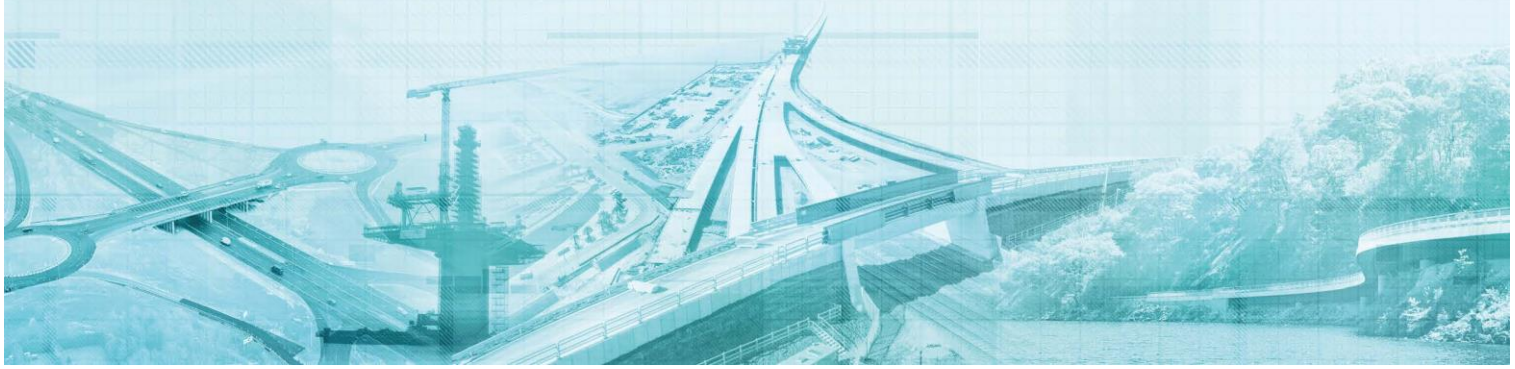
Bean Tunnel

Specification Appendices - Drainage and Service Ducts

Kent County Council

Document no: BRT-TG-XX-ZZ-SP-DD-0500

Revision: P02 Date: 11/03/2021



This page is intentionally left blank

Document Issue Record

Project:	Bean Tunnel
Report Title:	Specification Appendices - Drainage and Service Ducts
Client:	Kent County Council
Document No:	BRT-TG-XX-ZZ-SP-DD-0500
Revision:	P02
Status	S3 - Suitable for review and comment (for approval)
Date:	11/03/2021
Filename:	BRT-TG-XX-ZZ-SP-DD-0500

Rev	Date	Description and Purpose of Issue	Prepared	Reviewed	Approved
P01	15/12/20	First Issue	MS	LD	MJH
P02	11/03/21	Service Ducts added	AE	GH	AL

Issuing Office:	Tony Gee and Partners LLP, Hardy House, 140 High Street Esher, Surrey, KT10 9QJ
Tel:	+44 1372 461600
Email:	esher@tonygee.com

Contents

APPENDIX 5/1 – Drainage Requirements 1
1. Pipe Networks 1
2. Road Gullies 3
3. Chambers 4
APPENDIX 5/2 – Service Duct Requirements 9
1. Requirements for Street Lighting Ducts 9
2. Requirements for Duct Chambers 10
3. Requirements for Bedding, Surround and Backfill 11
APPENDIX 5/3: Surface Water Channels and Drainage Channel Blocks 13
APPENDIX 5/4: Fin Drains and Narrow Filter Drains 14
APPENDIX 5/5: Combined Kerb and Drainage Systems 15
APPENDIX 5/6: Linear Drainage Channel Systems 16
APPENDIX 5/7: Thermoplastic Structural Wall Pipes and Fittings 17

APPENDIX 5/1 – Drainage Requirements

1. Pipe Networks

1.1. Design Criteria

1.1.1. The drainage design is based on analysis using the Modified Rational Method described in the Wallingford procedure. The following design criteria shall apply:

a. Nature of the Catchment – The catchment is the carriageway and footway/cycleway together with the associated earthworks, side roads and junctions.

b. Time of entry shall be 2 minutes.

c. Storm Frequency – all new pipes in the drainage network shall be designed to meet the following parameters:

- No surcharging of the drainage system during the 1 in 5 year return period storm;
- No surface water flooding of the drainage system during all storm durations, up to and including the 1 in 30 year event;
- Surface water flooding of the drainage system for 1 in 100 year return period is permitted, providing that overland flows may be directed along the highway corridor to Sustainable Drainage Systems without affecting property.
- Rainfall intensities of the design storms up to a 1 in 100 year return period will be increased by 40% to allow for climate change, as per the latest guidance from the Environment Agency document Adapting to Climate Change : Advice for Flood and Coastal Erosion Risk Management Authorities.

1.1.2. Rainfall Intensity – The design is based on FSR point data.
Pipe Flow Velocities:

- Minimum pipe velocity shall be 0.75 m/s
- Maximum pipe velocity shall be 3.0 m/s

1.1.3. Drain Sizes:

- The minimum diameter for carrier pipes / filter drains shall be 150mm
- Gully connections shall be 150mm diameter.

1.2. Permitted Pipe and Bedding Combinations

1.2.1. The following types of pipe from approved manufacturers may be used for highway surface water drains:

a. Concrete pipes made with sulphate resisting cement to BS 5911-1: 2002 +A2:2010

b. Thermoplastic pipes, with current BBA Certification and in accordance with Appendix 5/7.

1.2.2. Pipe and Bedding Combinations shall be in accordance with Standard Detail drawing KCC-HTW-500-051.

1.2.3. Cover to Drains – The preferred minimum cover to all drainage pipes is 1.2m under carriageways and 0.9m under footways and soft verges. Pipes with less cover shall be of extra strength and surrounded by 150mm thick ST2 concrete with flexible joints at no more than 5m centres.

1.2.4. 4. Pipes for gully connections shall be 150mm. The preferred minimum cover to the gully pipes is 1.2m under carriageways and 0.9m under footways and soft verges. Connections with less cover will have type Z concrete bed and surround, while gully connections with greater cover will have Type S full granular bed and surround. Concrete to gully connections shall be Mix ST2 with sulphate resistant cement in accordance with SHW clause 2603.

1.3. Pipe Layering

1.3.1. Joints in surface water drains:

i. All pipe joints shall be flexible.

ii. All surface water pipes shall be laid to smooth flowing horizontal alignments conforming to the alignment of the carriageway, with a maximum deviation of 2 degrees at the joints.

iii. Joints in surface water drains shall be watertight complying with Sub-Clause 3 of Clause 504 of the SHW.

iv. Filler board for use at pipe joints to preserve the flexibility of concrete protected pipelines shall be 18mm thick for pipes up to 450mm diameter and 36mm pipes over 450mm in diameter and shall comply with BS EN 322 / BS EN 323 and Clause 1015 of the SHW.

1.3.2. All branch connections to pipelines shall be made using:

i. Formed junctions, or

ii. Uni-junctions.

Saddles shall only be permitted for achieving connection to an existing drainage system such as repairs to existing gully connections and only with the Employer's approval.

1.4. Drainage Schedules

1.4.1. See document reference BRT-TG-XX-ZZ-RG-DD-0500 for a list of drainage schedules.

2. Road Gullies

2.1. Design Criteria

2.1.1. Details of proposed adjustments to gullies can be found in Standard Detail drawing KCC-HTW-500-014

2.1.2. The drainage design is based on analysis using the Modified Rational Method described in the Wallingford procedure. The following design criteria shall apply:

i. Spacing of gullies in accordance with CD 526 based on a 1 in 5 year design storm event and a 1m flow width. Road assumed to be subject to ordinary maintenance (m=1).

ii. 2minM5 = 4.00mm (rainfall depth for 2 minutes of 5 year return period)

iii. The allowable surcharge flow width during a 1 in 5 years shall be 1 m.

iv. The maximum length for any gully connection shall be 20m.

2.2. Gully Gratings

2.2.1. Gully gratings and frames must be non-rocking and cast iron to BS EN 124:2015. The frame shall be bedded on a gauged Class 1 (3:1) sand/cement mortar and either 2 or 4 courses of Engineering Brickwork Class 'B' to BS EN 771-1:2011.

2.2.2. All gully grating and frames to be 'hinged' heavy duty ductile iron, minimum grade D400. and shall be installed on the side facing oncoming traffic. Minimum opening area 450mm x 450mm and minimum waterway area of 1200cm2 with frame at least 150mm deep.

2.2.3. Gully covers and any other carriageway and footway or cycleway ironwork shall not be installed until the carriageway binder course layer is laid. During the construction process protection shall be given to all gullies and chambers from the ingress of debris.

2.2.4. Gully gratings and frames to be set 0-6mm below the surface of the road channels, carriageway or footway surface.

2.3. Gully Construction

2.3.1. KCC Standard Detail drawing KCC-HTW-500-009 shows details of gully and gully pot construction. Suitable provision shall be made to prevent the pots floating and distorting when the concrete surround is placed and compacted. The installations shall be entirely in accordance with the British Board of Agreement (BBA) approval certificate requirements. The Engineer would expect the BBA Requirement to at least be equivalent to a concrete base slab provided below the pot bed and surround and which may take the form of a paving slab set on 150mm of ST4 in-situ concrete bed and surround to minimum grade ST4 (C16/20) to gully pot.

2.4. Gully Schedules

2.4.1. See document reference BRT-TG-XX-ZZ-RG-DD-0500 for gully schedules.

3. Chambers

3.1. Design Criteria

3.1.1. Maximum spacing of chambers shall be 100m.

3.2. Catchpit cover/frames

3.2.1. All manhole covers and frames shall be kite-marked products to BS EN 124:1994 and badged S.W (surface water). In the carriageway covers shall be Heavy Duty: BS EN 124 reference D400 with a clear opening of 600mm diameter unless noted otherwise and minimum frame depth of 150mm and have a polished Skid Resistance Value (SRV) of >45. In the verge covers shall be Heavy Duty: BS EN 124 reference C250 with a clear opening of 600mm and minimum frame depth of 75mm.

3.2.2. Manhole covers and any other carriageway and footway or cycleway ironwork shall not be installed until the binder course layer is laid. During the construction process protection should be given to all gullies and chambers from the ingress of debris.

3.2.3. The frames shall be bedded on a gauged Class 1 (3:1) sand/cement mortar to SHW clause 2402 and between 2 and 4 courses of Engineering brickwork Class B to BS EN 771-1:2011. The use of accelerating admixtures to be agreed with the Employer prior to use.

3.2.4. Alternative bedding materials may be permitted but will require the approval of the Employer prior to commencement.

3.3. Catchpit Construction

3.3.1. Catchpits shall be constructed to enable access to be provided to the surface water drainage network.

3.3.2. Catchpits must be in accordance with Clause 507 of the Specification and KCC Standard Detail drawing KCC-HTW-500-001.

3.3.3. Catchpits shall be constructed of precast concrete ring sections, to the requirements of BS5911. All catchpits must be watertight on completion.

3.3.4. All catchpits are deemed to be confined spaces and the Contractor is to fully comply with all relevant legislation regarding entry into the same and to give all notices applicable to this type of activity.

3.3.5. Prior to commencing a drainage run which connects to an existing manhole or ties into an existing system, the Contractor shall verify and record the route and invert levels of the existing pipe/chambers and identify any side connections along its length. Any discrepancies shall be immediately reported to the Employer.

3.3.6. The first pipe joint outside any chamber or new structure shall be as close as practicable to the face of the chamber to permit satisfactory jointing and subsequent movement.

3.3.7. If pipes are made of clay or concrete the first pipes beyond the chamber shall be a rocker pipe and a spigot/socket butt and be of the lengths:

Pipe Diameter (mm)	Short Length Pipe Length (m)	Rocker Pipe Length (m)
D≤600	0.6	0.6
D>600	1.0	1.0

3.3.8. If thermoplastic structured wall pipes or other flexible pipes are used a rocker pipe and stub pipes at the interface with manholes are not required.

3.3.9. In places where a high water table is encountered, the buoyancy forces acting on chambers shall be determined prior to the commencement of construction and any significant discrepancies reported to the Designer.

3.4. Chamber Schedules

3.4.1. See document reference BRT-TG-XX-ZZ-SP-DD-0500 for chamber schedules.

4. Water Attenuation Features

Not Applicable

5. Other requirements

5.1. Requirements for cleaning of existing drainage systems

5.1.1. All existing carrier pipe runs to be incorporated into the proposed works shall be cleaned using high pressure jetting apparatus in such a manner to remove any deposited solids from within the pipes upon completion of all new/replacement pipe work and remedial treatments.

5.1.2. The pipes, when jetted and cleaned, shall be checked by drawing through a mandrel as Clause 509.4 with the exception that the mandrel shall be 20mm less than the diameter of the pipe.

5.2. Connection of new drains to existing drains

5.2.1. Any connections of new drains to existing drains are subject to approval by Kent County Council. Detail of replacement of existing ironwork are found in Standard Detail drawing KCC-HTW-500-015.

5.2.2. Connection to existing drains, chambers and channels shall be as per SHW Clause 506 and as indicated in the drainage drawings.

5.2.3. All relevant dimensions and levels of the existing pipes are to be verified prior to the commencement of construction and any significant discrepancies reported to the Designer.

5.3. Requirements for sealing, removal or grouting of existing drains

5.3.1. All existing gullies and chambers to be abandoned are shown on drawings BRT-TG-XX-ZZ-DR-HI-0501 to 502.

5.3.2. If there is any existing pipework to be abandoned shall be confirmed with the Employer prior to commencing the works. All existing pipework to be abandoned that is under the carriageway shall be sealed and grouted or removed in accordance with SHW Clause 506.3.

5.3.3. All existing chambers and gullies to be abandoned shall be sealed with well compacted concrete ST4 and ST2 respectively. In accordance with App 2/2??

5.3.4. Requirements for rapid setting bedding materials and the location where they will be required

5.3.5. Chamber tops and gully tops to be constructed on existing live roads shall be set in rapid setting bedding materials complying with the requirements of HA104/09 – Chamber Tops and Gully Tops for Road Drainage and Services as follows:

i. Material is non-shrink

ii. Material to have a minimum working life of 15 minutes

iii. Minimum compressive strength of 30 N/mm^2 at 3 hours

iv. Minimum tensile strength of 5 N/mm^2 at 3 hours

5.3.6. As-built requirements

5.3.7. On completion of construction, internal surfaces of sewers, gullies and manholes shall be thoroughly cleansed to remove all deleterious matter, without such matter being passed forward into existing public sewers or watercourses in accordance with Clause 509.5 of the SHW.

5.3.8. All drainage elements are to be left free from obstruction. On completion of the whole of the works the Contractor shall flush and CCTV survey all pipes (excluding narrow filter and fin drains) within the extents of the Site.

APPENDIX 5/2 – Service Duct Requirements

1. Requirements for Street Lighting Ducts

1.1.1. Service ducts layout requirements are shown on drawing numbers 1551-DFL-HLG-XX-DR-EO-13001 and 13002.

1.1.2. Ducts in footways shall be installed as per standard detail drawing KCC/SD/500/024.

1.1.3. Ducts in carriageways shall be installed as per standard detail drawing KCC/SD/500/025.

1.1.4. Ducts shall be inscribed 'STREET LIGHTING' AT 1.0m intervals.

1.1.5. Footway ducts shall be installed with a minimum depth of cover not less than 350mm at the highest point of the duct.

1.1.6. Carriageway ducts shall be installed with a minimum depth of cover not less than 600mm at the highest point of the duct.

1.1.7. The diameter of ducts shall be as indicated on the detailed lighting layout drawings 1551-DFL-HLG-XX-DR-EO-13001 and 13002.

1.1.8. Ducts for lighting equipment shall be constructed of structured twin-wall rigid MDPE to BS EN 61386-24 and SHW Clause 518 with a minimum thickness of 5mm, of 'normal duty impact resistance' type 450N, and have a smooth internal bore and ribbed outer profile.

1.1.9. Ducts shall be self-coloured in accordance with NJUG Publications Volume 1; street lighting shall be 'orange' in colour.

1.1.10. Ducts shall be inscribed 'STREET LIGHTING' AT 1.0m intervals.

1.1.11. Warning marker tape shall be constructed of W150mm thermoplastic material (PVC, PP or PE), described "CAUTION STREET LIGHTING CABLE BELOW" in 'black' characters on a 'yellow' background at 1.0m intervals.

1.1.12. Couplings and seals shall be used to connect consecutive lengths of ducts; ducts shall be axially aligned and securely fixed into position.

1.1.13. Following completion of the Works, ducts shall incorporate a brightly coloured draw rope constructed of thermoplastic material (PP or Nylon) and 5.3kN min breaking load secured at both ends.

1.1.14. Ducts shall be sealed or re-sealed against the ingress of foreign matter with purpose made split plugs, polyurethane (PU) expanding foam or an alternative suitable material; refer to HCD MCX 0814 drawing sheet 5 of 5. The rope at the end of sealed ducts shall have a minimum slack of 2.0m.

1.1.15. Ducts shall be installed and sealed in accordance with the manufacturer's recommendations.

1.1.16. Ducts shall be aligned straight and level to the routes described, except where duct runs end and for existing obstacle clearance.

1.1.17. Concrete protection required to ducts in verge or footway where depth of cover is less than 60mm.

1.1.18. Duct route and clearances of ducts in relation to utility services and drainage pipes subject to confirmation by an engineer on site prior to backfilling.

1.1.19. All duct locations shall be checked against the detailed design drawings. Any differences shall be recorded on the As-Built drawings for inclusion into the Health and Safety File.

1.1.20. Ducts shall be clear of obstructions, construction debris and detritus prior to the installation of any cable.

1.1.21. The Contractor shall take care when working near existing and new Statutory Undertakers (SU) service ducting, chambers and apparatus. Protection shall be provided, and disturbance minimised. SU representatives shall be given adequate prior notice, should any excavation moving or backfilling, or their service ducts or apparatus be required. The Contractor shall comply with the special requirements of the affected SU companies.

1.1.22. The system of ducting and cable draw pits for an installation shall be so constructed that any cable can be installed/replaced without the need for any excavation of civil works.

1.1.23. Clearance between street lighting and communications ducts shall be a minimum of 500mm.

1.1.24. Duct routes and clearances of ducts in relation to utility services and drainage pipes subject to confirmation by an engineer on site prior to backfilling.

1.1.25. Subject to condition, existing duct for RM05 is to be redirected and reused for LC01A/B.

1.1.26. Where required, the Contractor shall undertake site investigation to confirm the location of existing duct routes to determine the exact number and size of ducts, termination points to / from chambers and whether the ducts are of suitable condition for reuse. The survey should indicate whether the existing ducts can be reused, are not blocked or collapsed, and have sufficient capacity to accommodate the proposed cables.

1.1.27. Existing ducts impacted by the scheme are to be relocated and replaced as required.

1.1.28. The Contractor's attention is also drawn to Works Specification Appendix 14/1 where there is a requirement to undertake surveys of existing electrical equipment.

2. Requirements for Duct Chambers

2.1.1. Chambers for street lighting shall be as per standard detail drawing KCC/SD/500/023.

2.1.2. Chambers for street lighting shall be installed as per manufactures recommendations and standard detail drawing KCC/SD/500/023.

3. Requirements for Bedding, Surround and Backfill

3.1.1. Unless otherwise stated in the Contract, the following shall apply:

3.1.2. Verge, footway ducts shall be installed by open trench method.

3.1.3. Both longitudinal and local verge / footway ducts installed by open trench methods shall be bedded on and backfilled as per standard detail drawing KCC/SD/500/025.

3.1.4. Where topsoil is detailed, ducts within soft verge shall be backfilled to within 150mm of finished ground level. The remaining 150mm of trench shall be backfilled using topsoil and grass seeded.

3.1.5. Footway ducts shall be backfilled up to formation level.

3.1.6. Transverse service ducts installed under carriageway by open trench methods shall be bedded on and backfilled as per standard detail drawing KCC/SD/500/025.

3.1.7. The Contractor shall reinstate verge (unpaved); footway, beneath non-structural central reservation, under carriageway and carriageway widening (all paved) ground surfaces deemed as permanent (by definition), as per existing / required construction in materials like those removed:

3.1.8. Carriageway to SHW Series 700 requirements;

3.1.9. Footway to SHW Series 700 and 1100 requirements;

3.1.10. Verge to SHW Series 600 and 3000 requirements (top soiling and grass seeding specifically to SHW Clause 618 and 3005).

3.1.11. All reinstatement works shall be guaranteed for a period of 12 months from system takeover. Any failure in the reinstatement works during the warranty period shall be corrected / replaced at the cost of the Contractor.

3.1.12. The Contractor is reminded of his obligations defined in the New Roads & Street Works Act (NRSWA) 1991.

3.1.13. Trenches for ducts shall be backfilled to SHW Clause 505, 602 and Table 6/1. Material shall not be deposited within 500mm, or any other distances described in Appendix 5/1, of metallic structural elements forming part of the Permanent Works.

3.1.14. Bedding, haunching and surrounding of ducts to SHW Clause 503. Material shall not be deposited within 500mm, or any other distances described in Appendix 5/1, of metallic structural elements, concrete, cement bound materials, other cementitious materials or stabilised capping forming part of the Permanent Works.

3.1.15. Excavation, trimming and reinstatement of unpaved and paved areas to SHW Clause 706.

3.1.16. Otherwise, unacceptable ground and soft spots surrounding and at the bottom of all duct and chamber excavations, shall be removed and backfilled with Grade ST1 concrete mix;

disturbed ground surrounding adjacent services are also to be made good by the Contractor.

3.1.17. The Contractor shall ensure the works do not block or disrupt adjacent existing services; protection via Terram or similar approved wrapping to be used.

3.1.18. All sealed and re-sealed ducts shall not be backfilled until inspected and approved by the Project Manager.

3.1.19. Excavation around chamber foundations to be backfilled with general granular fill Class 1A - 1C and compacted to SHW Clause 602, 604 and 612. Where mechanical compaction is impracticable, the excavation shall be backfilled with Grade ST2 concrete mix.

3.1.20. Chambers shall be installed on a bed formed of a 150mm minimum deep layer of Grade ST4 concrete lean mix in situ and have a minimum surround of 150mm Grade ST4 concrete mix.

Chambers shall be provided with a drainage hole via a pre-formed 100mmØ single-wall MDPE rigid duct through the chamber foundation, leading to an adequate soakaway, provided as a means to prevent waterlogging at the chamber base.

APPENDIX 5/3: Surface Water Channels and Drainage Channel Blocks

Not Used

APPENDIX 5/4: Fin Drains and Narrow Filter Drains

Not Used

APPENDIX 5/5: Combined Kerb and Drainage Systems

Not Applicable

APPENDIX 5/6: Linear Drainage Channel Systems

Not Used

APPENDIX 5/7: Thermoplastic Structural Wall Pipes and Fittings

4. Information to be Provided to the Contractor

4.1.1. The Contractor shall provide the following information, in accordance with sub-Clause 518.2, for the range of pipes and fittings (to be verified by the Certification body - see sub-Clause 518.15):

i. Technical drawings showing dimensions and tolerances including sealing rings and weight per metre, together with properties, as specified in sub-Clauses 518.3 and 518.5.

ii. Material specification, as required in sub-clause 518.2:

Table 5/7.1: Underplasticised polyvinyl-chloride (PVC-U)

Property	Test Method Reference	Specification
Tensile Properties	BS EN ISO 6259, BS EN ISO 527-1	
Vicat	BS EN 727	
Longitudinal Reversion	BS EN 743	
K-value	BS EN 922	
PVC Content	EN 1905	
Density	BS EN ISO 1183-3, ISO 4451	
Heat Reversion	ISO 12091	
Effects Of Heating (injection moulded fittings only)	BS EN 763	

Table 5/7.2: Polyethylene (PE)

Property	Test Method Reference	Specification
Tensile Properties	BS EN ISO 6259, BS EN ISO 527-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133	
Density	BS EN ISO 1183-3, ISO 4451	
Melt Flow Rate	ISO 4440	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN 763	

Table 5/7.3: Polypropylene (PP)

Property	Test Method Reference	Specification
Tensile Properties	BS EN ISO 6259, BS EN ISO 527-1	
Oxygen induction time	BS EN 728	
Melt Flow Rate	BS EN ISO 1133	
Density	BS EN ISO 1183-3, ISO 4451	
Melt Flow Rate	ISO 4440	
Heat Reversion	ISO 12091	
Effects of heating (injection moulded fittings only)	BS EN 763	

Note: The Contractor is to complete the column headed “Specification” in Tables 1, 2 and 3 above.